US007188836B2

(12) **United States Patent**
Yamamiya

(10) **Patent No.: US 7,188,836 B2**
(45) **Date of Patent: Mar. 13, 2007**

(54) **COMPACT DRIVING UNIT FOR AN AUTOMATIC BANKNOTE RECEIVING AND STORING DEVICE**

(75) Inventor: **Takahito Yamamiya**, Iwatsuki (JP)

(73) Assignee: **Asahi Seiko Co., Ltd.**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 320 days.

(21) Appl. No.: **10/657,376**

(22) Filed: **Sep. 8, 2003**

(65) **Prior Publication Data**

US 2004/0119225 A1 Jun. 24, 2004

(30) **Foreign Application Priority Data**

Sep. 9, 2002 (JP) 2002-263313

(51) **Int. Cl.**
B65H 29/38 (2006.01)

(52) **U.S. Cl.** **271/177**; 271/180

(58) **Field of Classification Search** 271/177, 271/180, 181; 109/45, 47; 194/206, 207; 209/534

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,372,361	A *	12/1994	Isobe et al.	271/181
5,411,249	A *	5/1995	Zouzoulas	271/181
5,676,366	A *	10/1997	Polidoro	271/176
5,730,271	A *	3/1998	Buchman et al.	194/206
6,659,452	B2 *	12/2003	Abe et al.	271/181
6,712,352	B2 *	3/2004	Bergeron et al.	271/180
6,948,607	B2 *	9/2005	Ito et al.	194/206
2002/0060405	A1 *	5/2002	Iwai et al.	
2002/0175463	A1 *	11/2002	Abe et al.	271/177
2003/0137095	A1 *	7/2003	Ito et al.	271/176

FOREIGN PATENT DOCUMENTS

JP	2003-123121	*	4/2003

* cited by examiner

Primary Examiner—Patrick Mackey
Assistant Examiner—Thomas Morrison

(57) **ABSTRACT**

A compact driving unit for an automatic banknote receiving and storing unit. The banknote receiving and storing unit includes a banknote accepting unit, a safe unit, a transporting unit for moving an accepted banknote to a position adjacent the safe unit, a translating unit for non-rotationally displacing the accepted banknote into the storing section of the safe unit, and a driving lever pivoted by a driving crank in the transporting unit to operate the translating unit. The safe unit and the transporting unit are removable from a chassis.

9 Claims, 7 Drawing Sheets

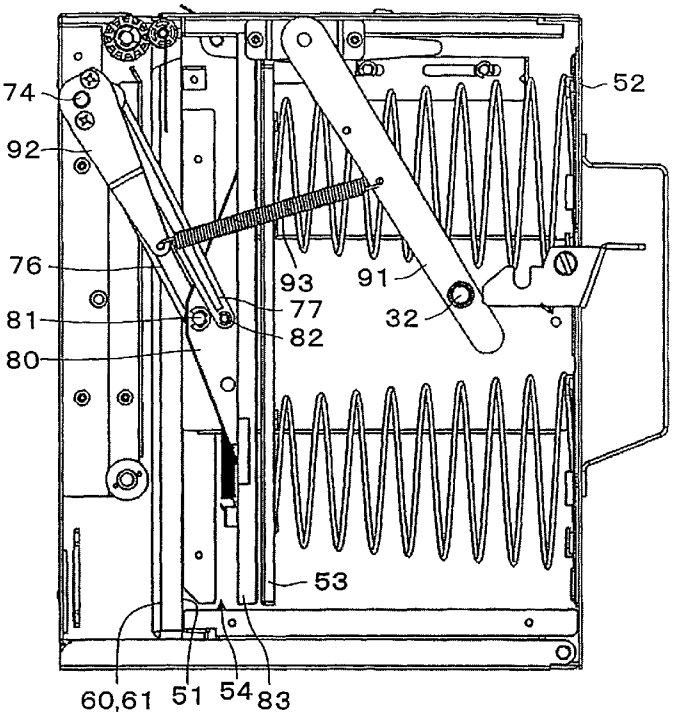


Fig. 1

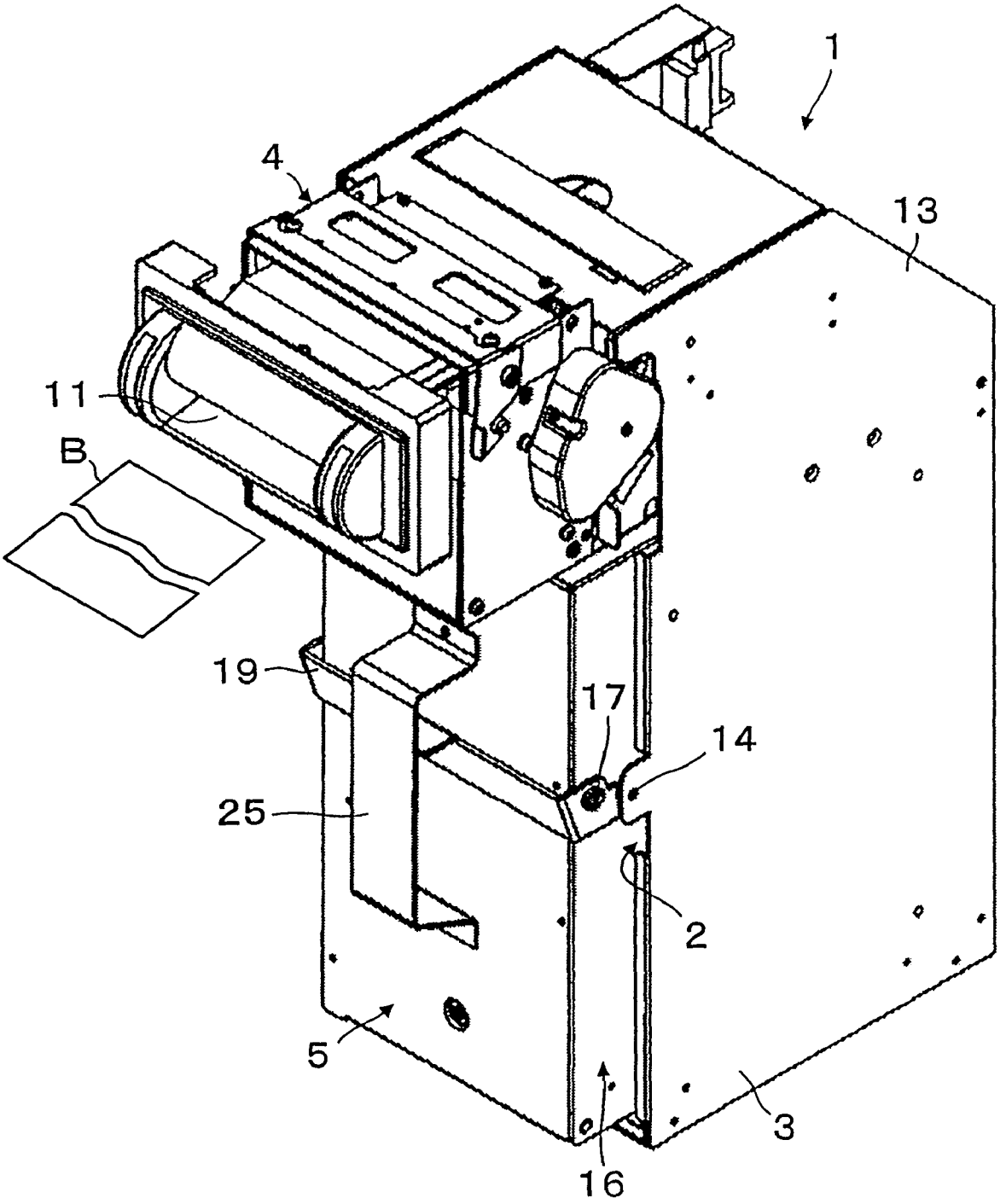


Fig. 2

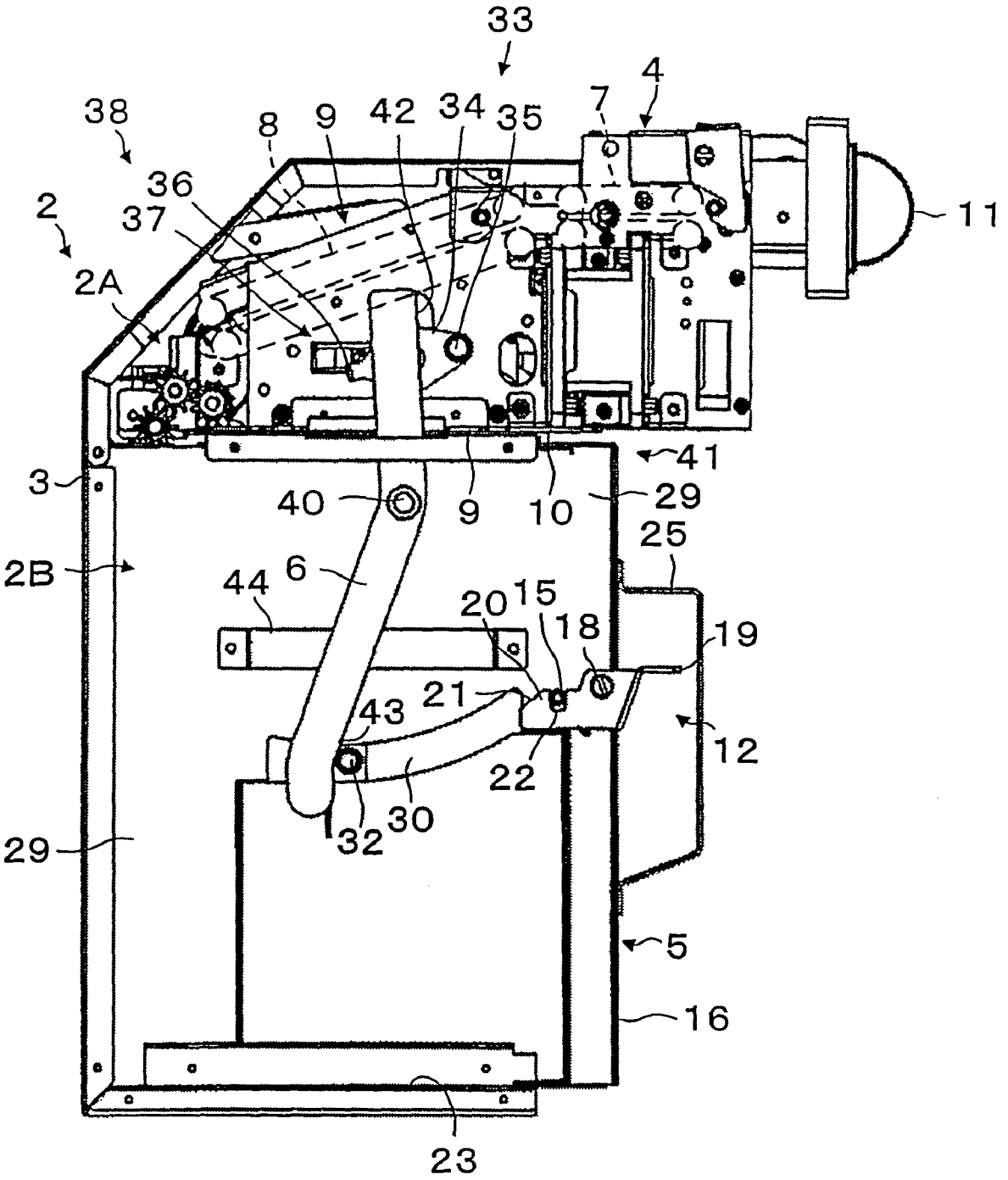

33
4
38
8
9
42
34
35
7
36
37
2
2A
11
41
3
40
9
10
29
25
2B
44
6
20
15
18
19
21
43
12
22
30
32
29
5
16
23

Fig. 3

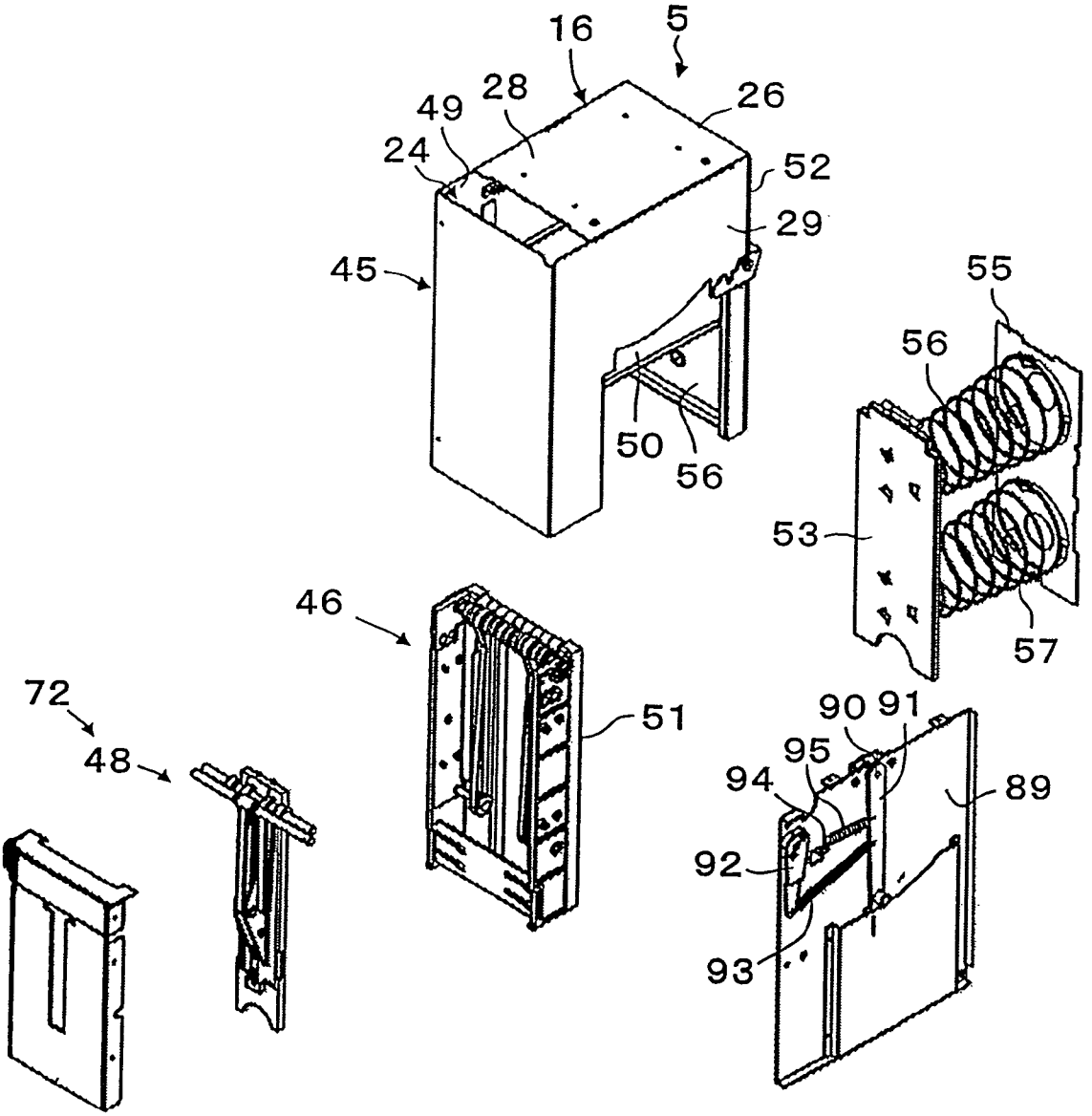

16
5
28
49
26
24
52
29
45
55
56
50
56
53
57
46
51
72
48
90
91
95
94
89
92
93

Fig. 4

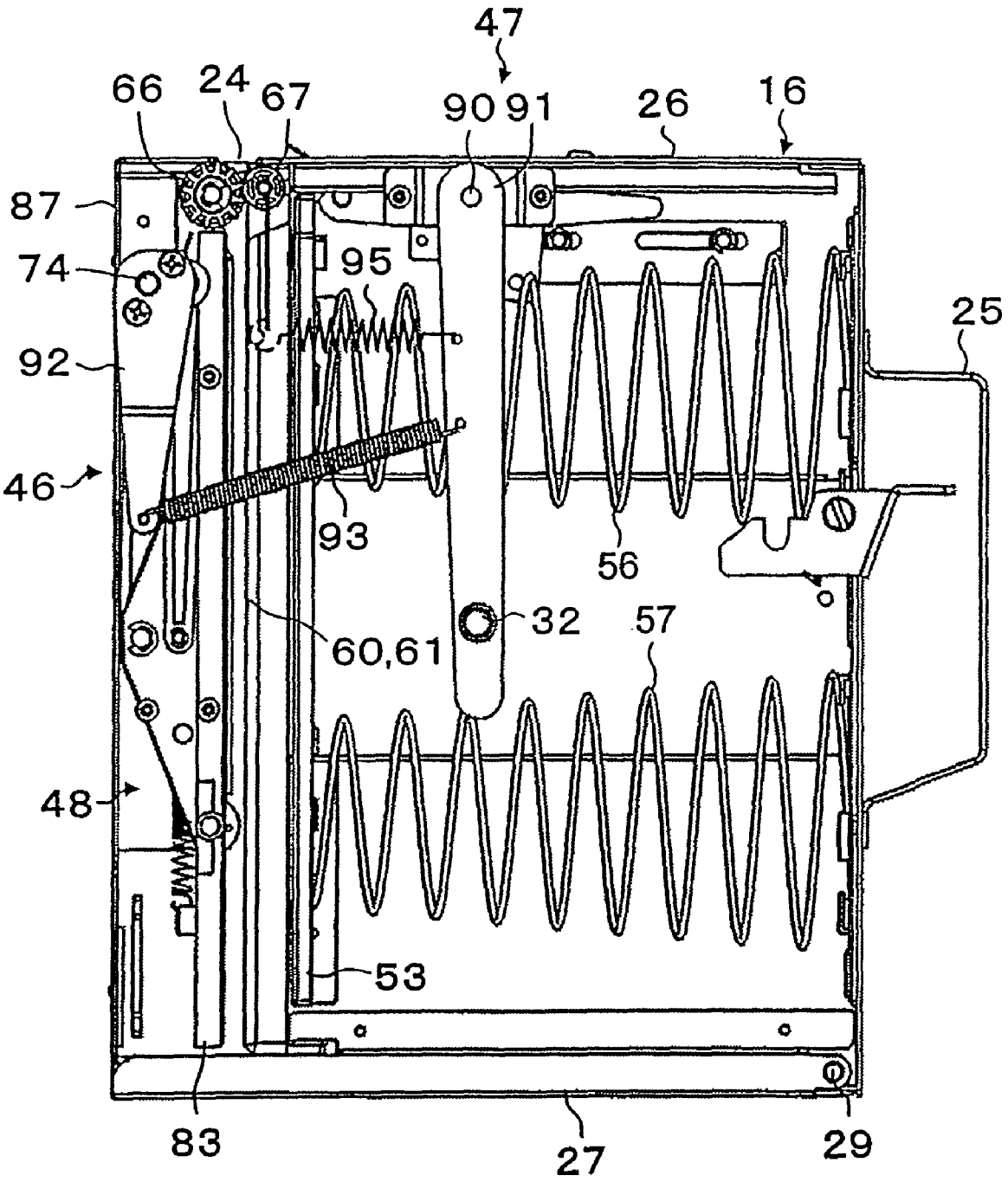

47
66
24
67
90
91
26
16
87
74
95
25
92
46
93
56
32
57
60,61
48
53
83
27
29

Fig. 5

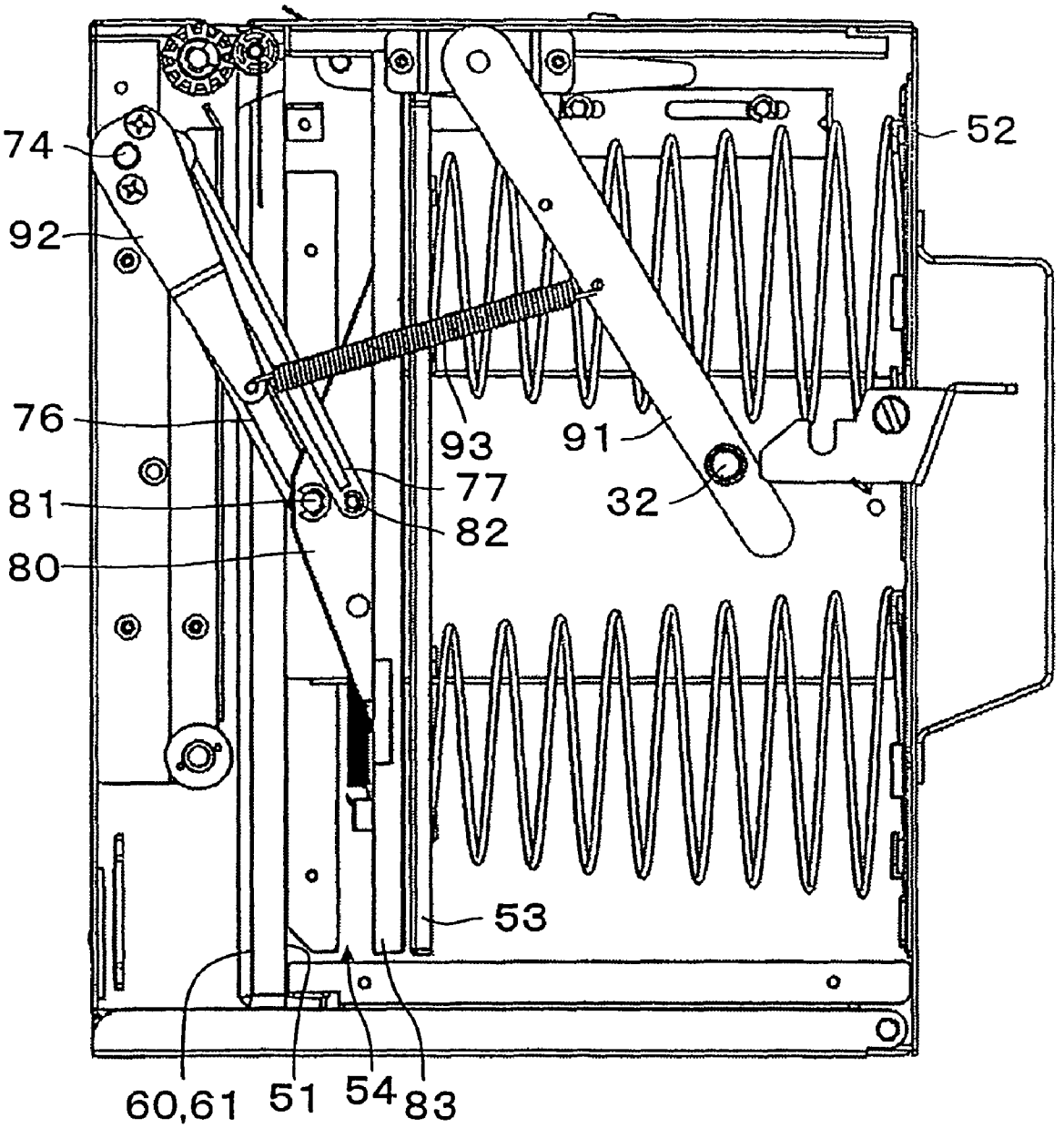


Fig. 6

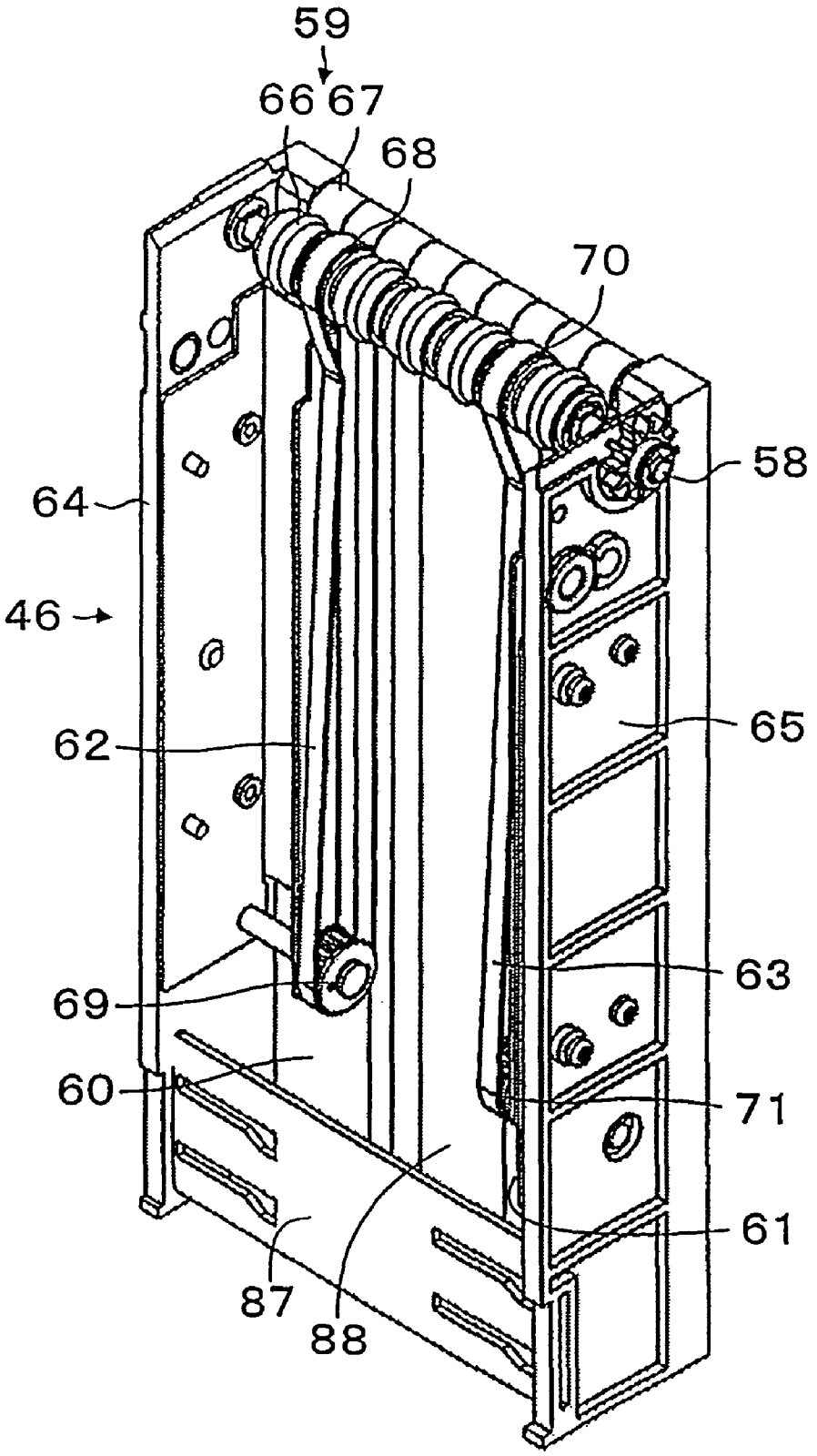
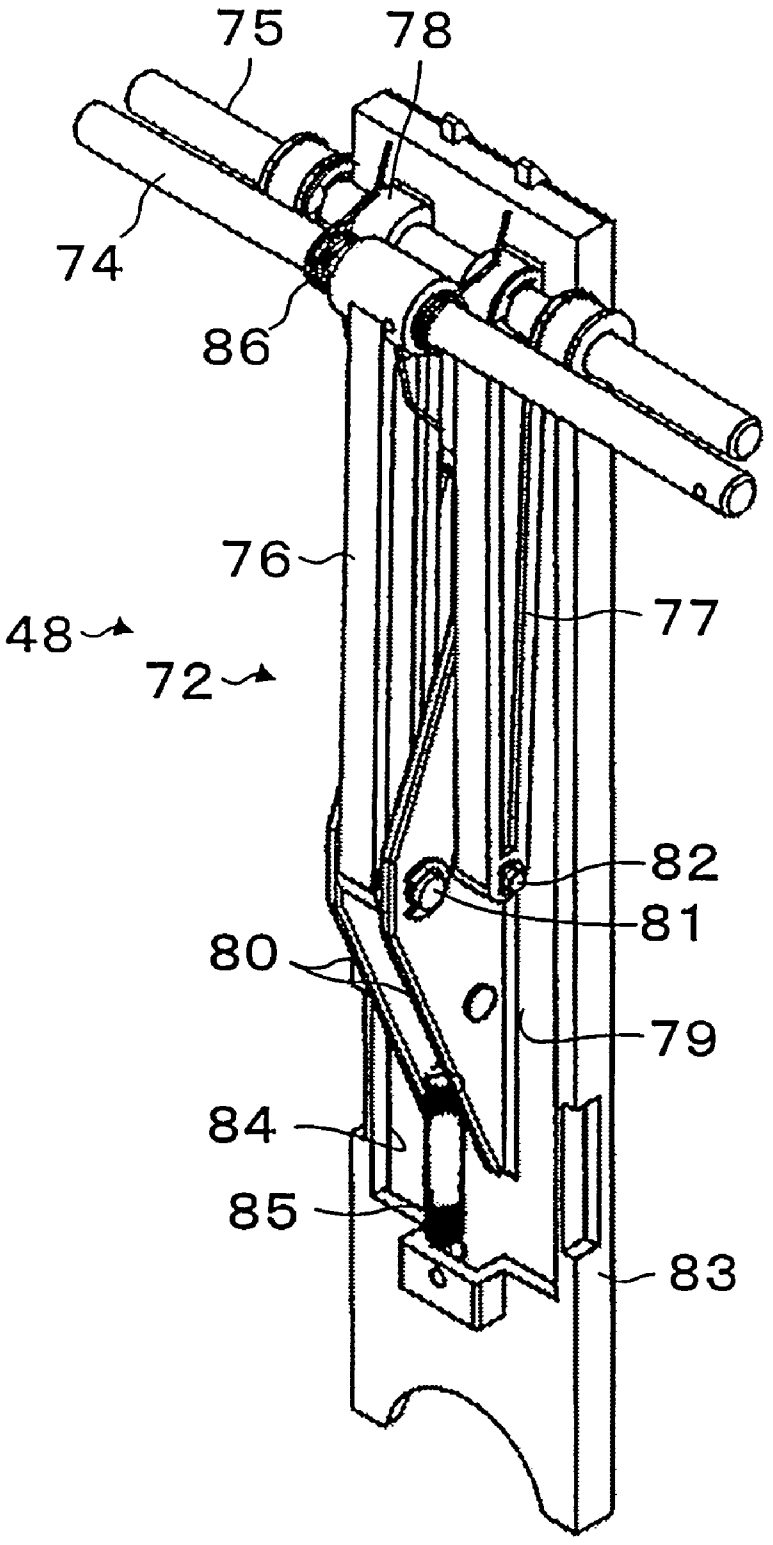


Fig. 7



COMPACT DRIVING UNIT FOR AN AUTOMATIC BANKNOTE RECEIVING AND STORING DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application is based on an application number 2002-263313 filed in Japan, dated Sep. 9, 2002.

FIELD OF THE INVENTION

The present invention is related to a banknote handling device and more particularly to a compact driving unit for an automatic banknote receiving and storing device for use in a vending machine or banknote changer where a banknote can be translated by a non-rotational displacement into a storing section by a translating unit that occupies a relatively small space.

DESCRIPTION OF RELATED ART

Previously, small, automatic banknote receiving and storing units are known for use in a vending machine or a banknote changer where a received banknote is pushed into a safe unit by a pushing unit, and the banknote is stored. The pushing unit includes a pushing board and a moving unit such that the pushing board moves while keeping the banknote parallel to the storage orientation.

Such a moving unit is disclosed in the Japanese Patent Document 2922441 which corresponds to U.S. Pat. No. 5,836,435 granted to Fujita, et al. In the Fujita et al. reference, a pair of crossed links pivot on a supporting point located at a crossing point, and the links reciprocate in a scissors like motion to drive a pushing board when a motor operates an attached crank located adjacent to the crossed links. As a result, the pushing board can reciprocate to push a banknote into a storing section.

Another type of transporting unit is disclosed in the Japanese Laid Open Patent Application 8-202923 which corresponds to U.S. Pat. No. 5,411,249 granted to Zouzoulas. In this reference, a rotating crank causes a linkage to pivot at a middle point to move a pushing plate. The pushing plate moves a banknote into the storing section while maintaining an orientation parallel to the storing orientation.

Generally, a crank can be located parallel to the linkage which prevents the linkage from being made smaller, since the linkage must be at least of the same diameter as the crank. Also, if the linkage pivots in series towards the direction of the storing section, an adequate area for the movement must be maintained, and a larger space is required. If the size of the receiving and storing device is limited, the storing quantity will be undesirably reduced.

Accordingly, there is still a demand in the prior art to provide a unique compact design to conserve space while maintaining a larger storing capacity.

SUMMARY OF THE INVENTION

The present invention addresses the limitations of the prior art by providing a compact banknote receiving and storing device that includes a novel transporting linkage operated by a driving lever.

The compact driving unit for an automatic banknote receiving and storing unit includes a box like chassis including a storing section, a banknote accepting unit, a safe unit including a translating unit and a banknote storing section, a driving lever, and a transporting unit for the accepted banknotes. A banknote is received by the banknote accepting unit and determined if it is genuine. If the received banknote is determined to be genuine, it is passed to the transporting unit which moves the banknote to a position adjacent to the storing unit. From this position, a translating unit non-rotationally displaces the accepted banknote into the storing section of the safe unit. The translating unit includes a pushing board and a parallel linkage.

The driving lever pivots in a plane which is parallel to the side of the safe unit, which is parallel to the plane traversed by the transporting unit and safe unit as it is attached to or removed from the chassis. As the transporting unit and safe unit are inserted into the chassis, the driver on the driving crank engages with a driven end of the driving lever while a driven pin on the safe unit engages with the driving end of the driving lever.

The driven pin on the safe unit is mounted on a first driven lever and receives a driving force from the driving lever. The first driven lever is linked with a second driven lever by an elastic member that applies a variable contraction force so that when the first driven lever receives a driving force, the second driven lever receives a driving force through the elastic member. The second driven lever operates the translating unit to non-rotationally displace a banknote into the safe unit storing section.

The amount of force applied by the translating unit is varied and limited by the elastic member to accommodate a difference in the translating force applied based on the variable quantity of banknotes stored in the storing section. If the storing section is nearly full of banknotes, the force resisting the translating of additional banknotes into the storing section can be larger than when the storing section is mostly empty. Hence, the elastic member limits the amount of force applied to a translated banknote thereby reducing the possibility that the banknote may be damaged in the translating and storing process.

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and features of the present invention, which are believed to be novel, are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages, may best be understood by reference to the following description, taken in connection with the accompanying drawings.

FIG. **1** shows a perspective view of a compact driving unit for an automatic banknote receiving and storing device of an embodiment of the present invention.

FIG. **2** is a left side view of the compact driving unit for an automatic banknote receiving storing device with a left side cover removed.

FIG. **3** is an exploded perspective view of the safe unit.

FIG. **4** is a cross sectional view of the safe in a standby situation when not actively translating a banknote in the storing section.

FIG. **5** is a cross section view of the safe when it translates a banknote into the storing section.

FIG. **6** is an enlarged perspective view of the banknote transporting unit of the safe of the embodiment.

FIG. **7** is an enlarged perspective view of a translating unit.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the preferred embodiments, it will be understood that they are not intended to

limit the invention to these embodiments. On the contrary, the intention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims.

Furthermore, in the following detailed description of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be obvious to one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well known methods, procedures, components, and circuits have not been described in detail as not to unnecessarily obscure aspects of the present invention.

In reference to FIGS. **1**–**4**, the compact driving unit for an automatic banknote receiving and storing device **1**, also called a banknote receiving and storing unit **1**, includes a box like chassis **3** including a storing section **2**, a banknote accepting unit **4**, a safe unit **5** including a translating unit **48** and a storing section **54**, a driving lever **6**, and a transporting unit **9** for the accepted banknotes. The transporting unit **9** includes a first transporting unit **7** and a second transporting unit **8** for receiving accepted banknotes (verified authentic banknotes) from the banknote acceptor **4** and moving the accepted banknotes through the first transporting unit **7** and the second transporting unit **8** which are located in series with the banknote acceptor **4** to transport a received banknote B through the transporting unit when the received banknote B has been verified.

Various mechanisms and sensors are known for determining whether a banknote is genuine or counterfeit, and accordingly are not included herein. In this specification, a banknote is a generic name which may include a note, folding money, a script, a check, a security bond, a coupon, a ticket, or other similar article which may be accepted and transported as indicated herein. The transporting unit **9** is trapezoidal in shape and is located in the upper storing section **2**A which is separated from the lower storing section **2**B by the separating board **10**. The transporting unit **9** can slide on the separating board **10**. The transporting unit **9** is locked at a predetermined position to the body **3** by a locking unit (not shown).

The second transporting unit **8** may preferably include a pair of belts (phantom lines in FIG. **2**) which grip and transport the banknote B. The belts are driven by the first transporting unit **7**, but it is possible to change to another type of transport mechanism with a similar function of transporting a banknote from the banknote acceptor **4** to the safe unit **5**.

Banknote B is received at the banknote receiving slot **11** and is examined by the banknote acceptor prior to being passed to the first transporting unit **7**. Examined, as used herein, refers to a distinguishing function where a banknote is determined to be either genuine or counterfeit. When the banknote B is determined to be genuine, the banknote is transported to the safe unit **5** by the second transporting unit **8**, after which the transported banknote is stored in the banknote storing section **54**.

In reference to FIGS. **3**–**7**, the structure and functions of the safe unit **5** are explained. The safe unit **5** is a box like chassis and can be removed from the lower storing section **2**B. The safe unit **5** is located below the banknote transporting unit **9** and is held by a locking unit **12**. The locking unit **12** includes a pin **14** which is fixed at the right side cover **13**, a pin **15** which is fixed at the left side cover (not shown) and a locking lever **19** which is channel like in shape and pivots on shafts **17** and **18** which protrude from both sides of the outer cover **16** of the safe unit **5**.

The slanting guiding section **21** and U-grooves **22** are located at the hook section **20** which is located beside the outer cover **16**. The locking lever **19** pivots in the clockwise direction as shown in FIG. **2** by a spring (not shown) and is stopped by the outer cover **16**. When the safe unit **5** slides on the guiding rail **23** and is located at a predetermined position within a lower storing section **28**, the U grooves **22** have contact with pins **14** and **15** and the safe unit is kept at a predetermined position.

In reference to FIGS. **3**–**4**, the safe unit **5** receiving slot **24** is aligned with an exit point of the transporting unit **9**. The handle **25** is channel like in shape and is fixed at safe unit **5** of the side of the banknote acceptor **4**. The safe unit **5** can be detached and attached at chassis **3** by gripping the handle **25**, operating the locking unit, and moving the safe unit **5**. For example, the banknote receiving and storing unit **1** may be built as a part of a vending machine.

The outer cover **16** of safe unit **5** includes a box like outer case **26** which opens at the bottom using banknote access door **27** as shown in FIG. **4**. The banknote access door **27** can pivot on pin **29**. The banknote access door **27** is opened to remove accumulated banknotes in the banknote storing section **54**. The pin **29** is fixed at the bottom right corner of the outer case **26** as shown in FIG. **4**.

The banknote access door **27** is locked at the outer case **26** by a locking unit (not shown). The receiving slot **24** is oriented vertically in FIG. **4** and receives the accepted banknote B from the second transporting unit **8**. The opening for the receiving slot **24** is on the upper surface of the safe unit **5** located at the upper wall **28** of the outer case **26**. An elongated hole **30** in the shape of an arc is located at the left wall **29** of the outer case **26**. A driven pin **32** protrudes into the outside of the left wall **29** from the elongated hole **30**.

In reference to FIG. **2**, crank **34** is a disk and is fixed on the output shaft of the motor with a reducer (not shown) and is located at the left side wall of the transporting unit **9**. The driver **35** is a rotateable element and is attached at an eccentric position of crank **34**. Driver **35** can be a rolling element such as a roller bearing or a fixed pin. The operating plate **36** is a hook like protrusion and is formed at the opposite side of the crank **34** from driver **35**. The sensor **37** faces the rotating excursion of operating plate **36** and is fixed at transporting unit **9**. The operating plate **36** and the sensor **37** comprise a one rotation detecting unit **38**. When sensor **37** detects the presence of the operating plate **36**, the motor stops, and the crank **34** stops at a predetermined phase.

In reference to FIG. **2**, the driving lever **6** is attached to pivot near a midpoint on the fixed shaft **40**. The fixed shaft **40** is in turn fixed at the inside of the left side cover (not shown) of lower storing section **28** of chassis **3**. The driving lever **6** is bent or boomerang like in shape with an angle formed at the pivot point. The driving lever **6** can pivot in a plane that it is parallel to the edge surfaces of the transporting unit **9** and the safe unit **5** located respectively above and below the driving lever **6**. The driving lever **6** can also be a straight member to accommodate a different location of the driving crank **34** and driver **35**.

The driving lever **6** has a driven section **42** and a driving section **43**. The driven section **42** is a straight end section at the upper section of driving lever **6** at the side of attaching opening **41** of storing section **2** as shown in FIG. **2**. The driven section **42** has contact with the driver **35** as it traces an orbital motion. The driving section **43** is the lower bended section which is located at the lower section of driving lever **6** below the side of the attaching opening **41**. The driving section **43** has contact with the driven pin **32**.

The driving lever **6** is guided to pivot along the left side cover by guide **44** which is fixed at the inner surface of the left side cover. The driving lever **6** reciprocates once for every rotation of the driving crank unit **33**. The driven pin **32** is pivoted in the counter clockwise direction by driving section **43** of driving lever **6** as shown in FIG. **2**, and afterwards can be pivoted in the clockwise direction by a return spring **95**.

Next, in reference to FIGS. **3**–**7**, the structure inside the outer cover **16** of the safe unit **5** is explained. The banknote storing box **45**, storing transporting unit **46**, storing driving unit **47** and translating unit **48** are enclosed within the inside outer cover **16**. The banknote storing box **45** is composed of a right wall **49**, a middle left wall **50** which is fixed at the inside of left wall **29** of outer cover **16**, an upper wall **28**, a reverse surface **51** of the banknote guides **60** and **61**, a rear wall **52**, and a banknote access door **27**.

The banknote storing section **54** is enclosed by a right wall **49**, a middle left wall **50**, an upper wall **28**, a reverse surface **51**, a rear wall **52**, a banknote access door **27**, and a holding board **53**. The holding board **53** is attached at the end of a pair of spring **56** and **57**, the other end of which are fixed at the base **55**. Base **55** is fixed at the rear wall **52** of the banknote storing box **45**. The holding board **53** is urged toward the banknote guides **60** and **61** by springs **56** and **57** and can move in a left and right direction in note storing section **54** as shown in FIGS. **4**–**5**.

In reference to FIG. **6**, the storing transporting unit **46** includes the shaft **58**, the sending roller unit **59**, a pair of note guides (**60**, **61**), belt **62** which is located along note guide **60**, and belt **63** which is located along note guide **61** as shown in FIG. **6**. The pair of note guides (**60**, **61**) are located below the sending roller **59** and are away from each other at a predetermined distance.

The sending roller unit **59** includes the sending roller **66** which is fixed at shaft **58** which can rotate as fixed at a pair of side walls **64** and **65** located outside the banknote guides **60** and **61** and idling roller **67** which has contact with the sending roller **66**. The shaft **58** is rotated by the driving motor of first transporting unit **7** through the second transporting unit **8** as shown in FIGS. **2** and **6**.

The banknote guide **60** is a flat plate that is fixed at the side wall **64** and which extends perpendicularly under the idling roller **67**. Banknote guide **61** is similar to banknote guide **60**. The belt **62** is drawn between the timing pulley **68** which is fixed at shaft **58** and the idling pulley **69**. Belt **63** is similarly drawn between the timing pulley **70** and the idling pulley **71**. The contact pressure between belt **62** and the banknote guide **60**, and the contact pressure between belt **63** and the banknote guide **61**, can draw in a banknote B into the receiving slot **24**. While belts are preferably used, the storing transporting unit **46** can use rollers instead to provide the function of transporting and releasing the banknote B.

In reference to FIG. **7**, the translating unit **48** has a function which moves the received note in a non-rotational displacement from a position in the receiving slot **24** into the banknote storing section **54**. The translating unit **48** uses a pushing unit **72** to move the received banknote into the storing section **54**. A pair of shafts (**74**, **75**) are arranged in a parallel fashion and are separated from each other a predetermined distance as fixed in the side walls (**64**, **65**) adjacent to the sending roller unit **59**. The upper end of the first link **76** is radially attached and fixed at the shaft **74**. The second link **77** and third link **78** are similarly radially attached and fixed at the shaft **75** and are located on either side of the first link **76**. The links (**76**, **77**, **78**), also called link members, have the same length L and are driven from the same end as shown in FIG. **7**.

The lower end of each link (**76**, **77**, **78**) is attached at a pair of triangle brackets **80** which protrude from the sliding board **79** by pin **81**, and can pivot on pin **81**. The lower end of the second link **77** and the third link **78** can pivot at the base of the triangle bracket **80** by pin **82** so that the bracket is translated in a non-rotational displacement. The shafts (**74**, **75**) and the links (**76**, **77**, **78**) and the brackets **80** comprise a parallel linkage as shown in FIG. **7**.

The parallel linkage preferably has three link members and two triangular brackets, but can be embodied with two link members (**76**, **77**) and only one bracket **80**. The parallel linkage of the preferred embodiment has the advantage that a larger non-rotational displacement can be realized if the link members are not mounted on the same face of a single bracket **80**. The staggered positioning of the link members (**76**, **77**, **78**) allows for a larger non-rotational displacement of the bracket **80** and the attached pushing board **83**.

The sliding board **79** is a plate like structure inserted into a hollow portion **84** of a pushing board **83** so that the sliding board may move up and down a predetermined distance within the pushing board **83** as shown in FIG. **7** as the pushing board **83** is translated in a non-rotational displacement as shown in FIG. **5**.

The spring **85** is attached between the pushing board **83** and the triangle bracket **80** so that the pushing board **83** is urged upwards by the spring **85**. The side walls (**64**, **65**) are fixed at plate **87** to form a unit as shown in FIG. **6**. The translating unit **48** integrates the storing transporting unit **46** and the pushing unit **72** and is attached to the outer case **26**. In a standby condition, the first link **76** is urged in a clockwise direction by spring **86** (as shown in FIG. **7**) so that the pushing board **83** is located in the position (as shown in FIG. **4**).

In the standby condition, the pushing board **83** is located at the left-most position away from the banknote storing section **54**, and to the left of the banknote-guides **60** and **61** as shown in FIG. **4**. The banknote guides (**60**, **61**) are separated by a predetermined distance to form an opening **88**. The opening **88** permits the passage of the pushing board **83** through the opening to push a banknote B from a position in the receiving slot **24** into the banknote storing section **54**. A high friction member (not shown) can be attached at the contacting surface of pushing board **83**, to further reduce the slip between note B and the contacting surface of the pushing board **83**. The high friction member can be, for example, a rubber sheet.

In reference to FIG. **4**, the storing driving unit **47** is now explained. The storing driving unit **47** drives the translating unit **48** (pushing unit **72**). The separating wall **89** is fixed inside the outer case **26** at a predetermined distance away from the left wall **29**. The first driven lever **91** extends downwards and pivots at a fixed shaft **90** which is located at the upper section of the separating wall **89**. The driven pin **32** is fixed at the lower side wall of the driven lever **91**. The driven pin **32** can be changed to a roller bearing, a roller element, or a fixed pin such as the driver **35**.

The second driven lever **92** extends downwards and is fixed at shaft **74** of the pushing unit **72**. The spring **93** is attached between the first driven lever **91** and the second driven lever **92**. The spring **93** is an elastic member for applying a variable contraction force along an axis defined by its end points. The contraction force depends on the displacement between the end points where a larger contraction force is caused by a larger displacement, while a smaller contraction force is caused by a smaller displace-

ment. The spring **93** may be replaced with a rubber band or other such member with a similar resilient function. Spring **95** is attached between the first driven lever **91** and a projection **94** which is fixed at the separating wall **89**. Similarly, in this specification, the spring **95** may also be replaced by an elastic member.

When the first driven lever **91** is pivoted in the counter-clockwise direction by the driving lever **6** through driven pin **32** (as shown in FIG. **4**), the spring **93**, the second driven lever **92**, and the shaft **74** are pivoted in the same direction, and the pushing board **83** is moved into the storing section **54** by the parallel linkage. At the same time, the sliding board **79** moves upwards by the parallel linkage, however it slides along the pushing board **83** to reduce any slip with the received banknote B as it is moved in a parallel fashion. When the driving lever **6** is not pushing driven pin **32**, spring **95** can pull the first driven lever **91** in a clockwise direction. The first driven lever **91** stops at a predetermined position by making contact with a bumper or stopper (not shown).

In reference to FIG. **1**, the operation of the banknote receiving and storing unit **1** is explained. Initially, there are no banknotes stored in the storing section **54** and the safe unit **5** is considered empty. A user grips the handle **25** of the safe unit **5** and inserts the safe unit **5** by sliding into the lower storing section **2**B of the chassis **3**. As the safe unit **5** is inserted into the lower storing section **2**B, the pins (**14**, **15**) make contact with their corresponding U-grooves **22**. The U-grooves **22** engage their corresponding pins (**14**, **15**) and the safe unit **5** becomes locked in the lower storing section **2**B of the chassis **3**.

In this position, receiving slot **24** is aligned with the outlet in the upper storing section **2**A of the transporting unit **9**. Accordingly, the outlet of transporting unit **9** is aligned with the sending roller unit **59** of safe unit **5**. At the same time, the driven pin **32** is located near driving section **43** of driving lever **6** so that the driven pin **32** is engaged in the pivoting plane of driving lever **6**.

Similarly, when the transporting unit **9** is attached in the upper storing section **2**A, the rear section of the transporting unit **9** is inserted into the attaching opening **41**, and the transporting unit **9** is slid into position. At the same time, driver **35** of the driving crank **33** moves towards driven section **42** of driving lever **6**, and it stops at a predetermined position by a bumper (not shown), and transporting unit **9** is locked. In this condition, driver **35** can move in a reciprocating fashion in the pivoting plane of driving lever **6** to alternately make and break contact with driving lever **6**, thus pushing the driving lever **6**.

In reference to FIGS. **2** and **4**, the standby condition is explained. Driver **35** is located on the banknote acceptor **4** side of the driving lever **6**. Accordingly, the driving lever **6** pivots in the counter clockwise direction driving section **43** and has contact with driven pin **32**. In the safe unit **5**, the first driven lever **91** is pivoted in the clockwise direction by spring **95**, and the first link **76** is pivoted in the clockwise direction by spring **86** so that the pushing board **83** moves towards the left. The top of the triangle bracket **80** has contact with the plate **87**. At the same time, the pushing board **83** is located at the opposite the banknote storing section **54** and is pulled upwards by the spring **85** so that the pushing board **83** is located in the uppermost position.

Next, in reference to FIGS. **1** and **5**, the storing operation is explained. When a banknote B is inserted into the banknote receiving slot **11**, it is detected by a sensor (not shown) starting the operation of the first transporting unit **7** and the second transporting unit **8**, and the banknote acceptor **4** examines the inserted banknote B. The banknote acceptor **4** examines the banknote B while transporting the banknote into the banknote acceptor unit **4** by the first transporting unit **7**.

If the banknote acceptor **4** determines the inserted banknote B is a counterfeit, the first transporting unit **7** rotates in the counter clockwise direction, and the banknote B is returned to the banknote receiving slot **11**. When banknote acceptor **4** detects the received banknote B is genuine, the banknote B is moved from the first transporting unit **7** to transporting unit **8** within the transporting unit **9**. The received banknote B is ultimately passed from the transporting unit **9** into the receiving slot **24**.

As shown in FIGS. **4** and **6**, the received banknote B is passed into the receiving slot **24** by being pulled between the sending roller **66** and the idling roller **67**. The received banknote B is pulled downwards and pressed in between the banknote guides (**60**, **61**) and the drive belts (**62**, **63**). When the trailing edge of the received banknote B (the upper end as shown in FIG. **4**) passes through the sending roller unit **59**, the sending roller unit **59** stops the rotation so that the received banknote B is held between the banknote guides (**60**, **61**) and the drive belts (**62**, **63**) in a position parallel to the opening **88**.

When the received banknote B is in this position, a motor with a reducing gear assembly (not shown) is activated and crank **34** rotates in the counter clockwise direction one full rotation. When the operating plate **36** is detected again in the standby position, the motor stops. When the motor is active, the driver **35** reciprocates in an orbital motion to push the driven section **42** of the driving lever **6** so that the driving section **43** pushes the driven pin **32** as the driving lever **6** pivots in a counter clockwise direction as shown in FIG. **2**. The transporting unit may be operated by one or more motors.

Further, when the driving lever **6** pivots in the counter clockwise direction, the driving section **43** pushes the driven pin **32** to the right as shown in FIG. **5**. In this case, the first driven lever **91** pivots in the counter clockwise direction and the second driven lever **92** follows by the action of spring **93**. In this case, the first link **76** is pivoted in the counter clockwise direction by the rotation of the shaft **74** causing the sliding board **79** to move in a parallel fashion toward the note storing section **54** forcing the pushing board **83** through the opening **88** to move banknote B into the storing section **54** and to the holding board **53**.

The motion of the links (**76**, **77**, **78**) causes the sliding board **79** to rise slightly on the arc during the travel. However, in this case, the pushing board **83** does not slip relative to the banknote B due to friction with the banknote B due to the sliding action of the sliding board **79** against the force of the spring **85**. After the banknote B is transported into the storing section **54**, the banknote B is first folded around the pushing board but then automatically self-flattens again after passing through the opening **88**.

If one or more banknotes are already in the storing section at this point, they are also moved by the pushing board as the driver traces a full circle in a reciprocating motion. Advantageously, a banknote transported through the opening **88** is not damaged since the amount of force applied to the transported banknote is limited by the pulling force of the spring **93**.

The driver **35** exerts force on the driving lever **6** to move a banknote B into the storing section during the first half of the reciprocating motion. In the second half of the reciprocating motion, the pushing board is being retracted from the storing section **54** by the force of the spring **95** which keeps

the driven pin **32** in contact with the driving section **43** of the driving lever **6** during the second half of the reciprocating motion of the driver **35**.

As the driving lever **6** returns by pivoting in a clockwise direction as shown in FIG. **2**, the second driven lever **92** is permitted to return to the standby condition by rotating in a clockwise direction as drawn by the springs **86** on both sides of the first link **76**. Thus, the moving speed of pushing board **83** depends on the rotation speed of crank **34** because driven section **42** has contact with driver **35**.

The holding board **53** stops in the condition that the banknote B is held between the holding board **53** and the right side of the banknote guides (**60**, **61**) so that a banknote B stored in the storing section is held between the banknote guides (**60**, **61**) and the holding board **53**. Similarly, the first link rotates in a clockwise direction to return to the standby position with the triangular bracket **80** resting against the plate **87**.

The descriptions of various orientations of elements, positions, and movements herein by using words such as up, down, left, and right are for convenience, and are not to be considered as limiting. For example, the embodiment may be utilized in a horizontal or rotated position.

Those skilled in the art will appreciate that various adaptations and modifications of the just-described preferred embodiment can be configured without departing from the scope and spirit of the invention. Therefore, it is to be understood that, within the scope of the amended claims, the invention may be practiced other than as specifically described herein.

What is claimed is:

1. A compact banknote safe, comprising:

a banknote storing section;

a first driven lever mounted in the banknote storing section for receiving a driving force;

a translating unit for non-rotationally displacing a pushing board to move a banknote into the banknote storing section, the pushing board being operated by a second driven lever; and

an elastic member attached between the first driven lever and the second driven lever, the elastic member applies a variable contraction force and elastically linking movement of the first driven lever to the second driven lever,

wherein the first driven lever can receive a driving force to move in a first direction thereby moving the second driven lever and causing the pushing board to move a banknote into the banknote storing section.

2. The compact banknote safe of claim **1**, further comprising:

a banknote access door for removing stored banknotes from the banknote storing section.

3. The compact banknote safe of claim **1**,

wherein the translating unit includes the pushing board and a parallel linkage assembly.

4. The compact banknote safe of claim **1**,

wherein the elastic member is a spring.

5. The compact banknote safe of claim **1**,

wherein the elastic member is a rubber band.

6. The compact banknote safe of claim **3**,

wherein the parallel linkage assembly further comprises:

a first link member having a first end, and a second end, the first end of the first link member being radially attached to a first shaft, the first shaft is rotated about an axis of the first shaft so that the second end of the first link member moves around the first shaft;

a second link member having a first end, and a second end, the first end of the second link member being radially attached to a second shaft, the second shaft can be rotated an the axis of the second shaft so that the second end of the second link member moves around the second shaft, the axes of the first shaft and the second shaft being parallel to each other, the first shaft and the second shaft being located a predetermined distance apart; and

a first bracket member mounted to the pushing board and to the second end of the first link member and the second end of the second link member by pins so that the bracket member will not rotate during displacement as the first shaft is rotated a predetermined amount.

7. The compact banknote safe of claim **6**,

wherein the translating unit includes a sliding board mounted between the parallel linkage assembly and the pushing board to allow the pushing board to maintain contact with a moving banknote without slipping.

8. The compact banknote safe of claim **6**,

wherein the parallel linkage assembly further comprises:

a third link member mounted parallel to the second link member, the third link member having a first end, and a second end, the first end of the third link member being radially attached to the second shaft, the second shaft can be rotated about the axis of the second shaft so that the second end of the third link member moves around the second shaft; and

a second bracket member mounted parallel to the first bracket member,

wherein the first link member is mounted between the first bracket member and the second bracket member while the second link member is mounted on the first bracket member on a side opposite from the first link member and the third link member is mounted on the second bracket member on the side opposite the first link member so that the parallel linkage assembly enables a non-rotational operative movement of the pushing board during contact with a banknote.

9. The compact banknote safe of claim **6**,

wherein the first bracket member is triangular in shape.

* * * * *